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# FOREST CONTROL

by

## CONTINUOUS INVENTORY

"---you shall not muzzle an ox when it is treading out the grain."

First Corinthians 9:9

Milwaukee, Wis.

May 1954

No. 2

What good is a forest trial balance? What is it worth?

It costs something to get, but is it worth anything when we get it?

Merle Lowden has answers which are also questions--  
"What is a new refrigerator worth? Why not drive a horse and buggy instead of that new car?"

Perhaps there is still another answer.

Somehow I am reminded of an old Pennsylvania Dutchman I used to know. Indeed, several of them, for there we stood--Nunnemacher, Brumbach, and Stott--looking over old Leibelsberger's fine specimen of the purple-fringed orchis.

The orchis was wonderful to us because it had come from a secret, unspoiled place in the hills of Pennsylvania. And it was beautiful in its own right.

Soon Leibelsberger's son became "wunnerfitzig", and strolled into the little greenhouse to see the strange flower.

"What's it worth, Pop?" was the young man's first question.

How well I remember the sadness, discouragement, and scorn in the old man's reply.

"My son," he said, "this flower is of no intrinsic worth. It has no value to you because you cannot see its value."

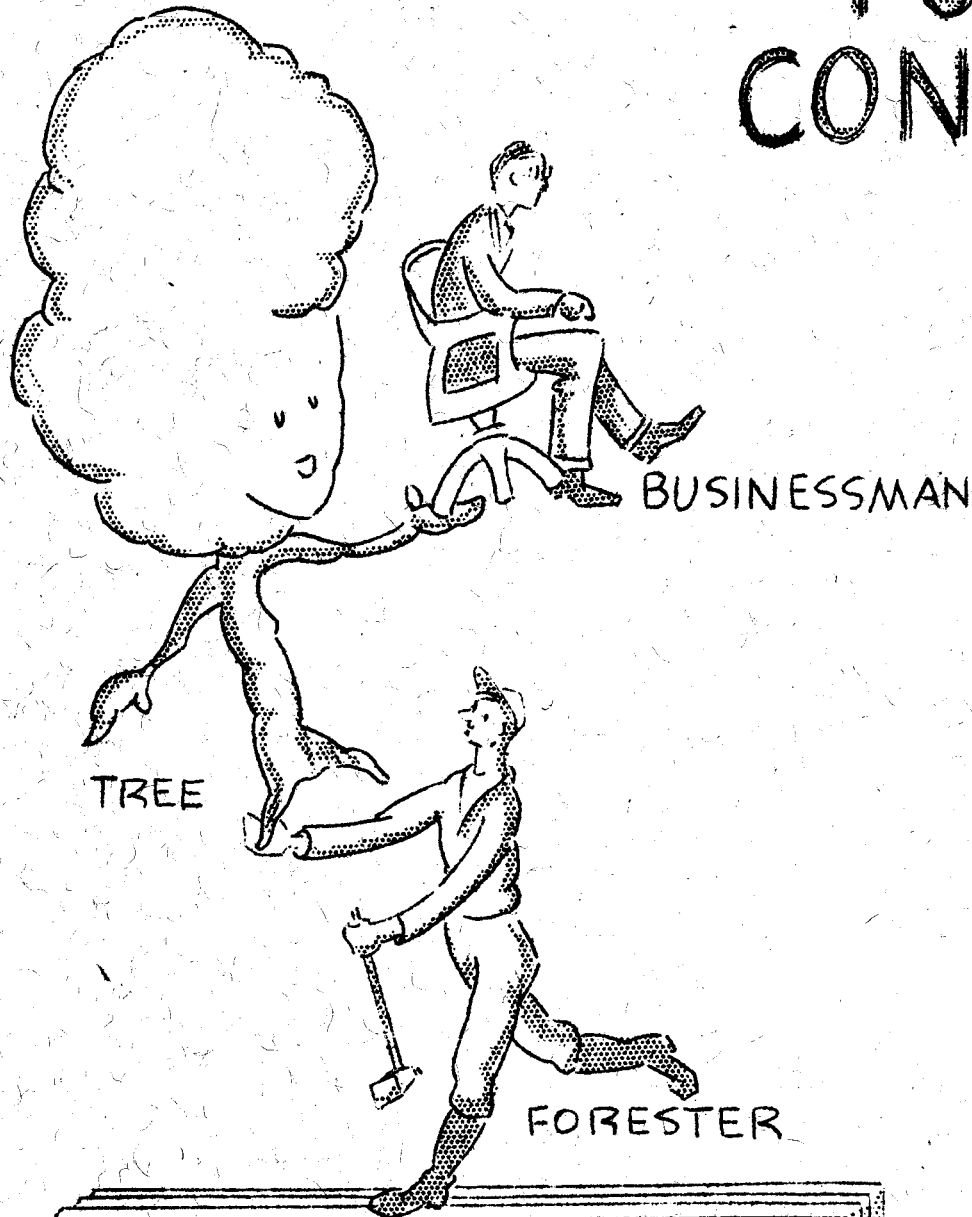
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Cal Stott The Yonder



# CONTINUOUS FOREST CONTROL



*A System of*  
**CHECKS and BALANCES**  
*for the*  
**MANAGEMENT**  
**OF THE FOREST**

OCT. 1953

On the pages to follow we offer again those principles by which good forestry has ~~been~~ guided many generations of foresters.

We also present and explain the use of new combinations of tools with which these principles may be more swiftly and economically realized.

### THE TOOLS

Modernized continuous forest inventory  
Improved techniques for permanent  
sample plots  
Systematic tree grading  
Complete electronic accounting  
Frequent trial balance of the  
changing forest  
Constant adjustment of physical and  
economic factors

### PLANS FOR RESEARCH

Time of Commencement:	Upon notification of successful award
Progress to Date:	This is shown by the outline enclosed. Short technical sections of the manuscript have been roughed out.
Expectation as to Completion:	We hope to finish all work on this project within one year from the date of award.
Place where Study will be Carried on:	Milwaukee, Wisconsin; Neopit, Wisconsin; Purdue University, Lafayette, Indiana; and in local forest areas.
Expectations as to the Publication of the Results:	No plan made to date
Ultimate Purpose of Study:	To increase the fund and flow of professional knowledge in forestry.

## TABLE OF CONTENTS

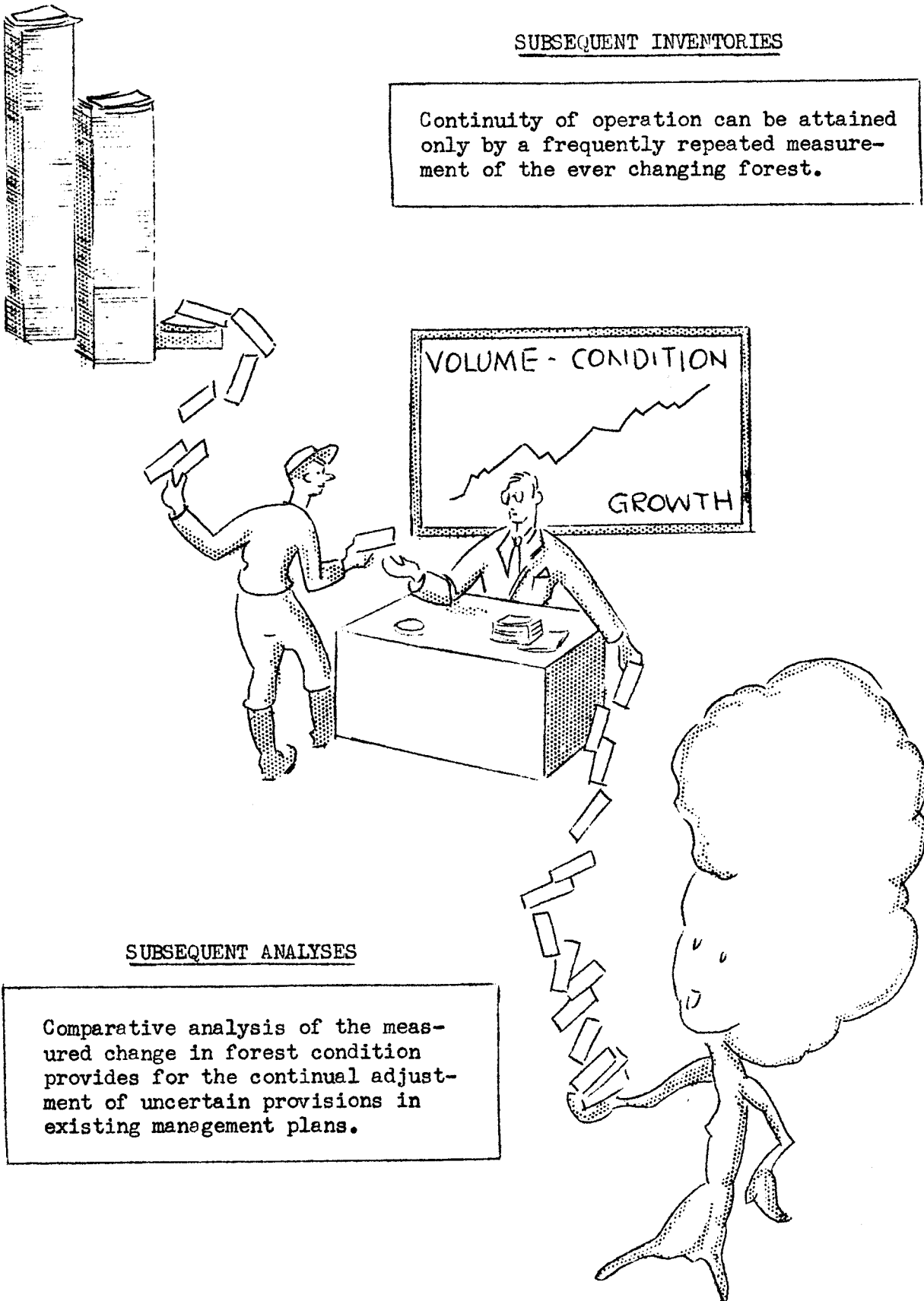
CHAPTER I	1
CHAPTER II	10
CHAPTER III	20
CHAPTER IV	30
CHAPTER V	40
CHAPTER VI	50
CHAPTER VII	60
CHAPTER VIII	70
CHAPTER IX	80
CHAPTER X	90
CHAPTER XI	100
CHAPTER XII	110
CHAPTER XIII	120
CHAPTER XIV	130
CHAPTER XV	140
CHAPTER XVI	150
CHAPTER XVII	160
CHAPTER XVIII	170
CHAPTER XIX	180
CHAPTER XX	190
CHAPTER XXI	200
CHAPTER XXII	210
CHAPTER XXIII	220
CHAPTER XXIV	230
CHAPTER XXV	240
CHAPTER XXVI	250
CHAPTER XXVII	260
CHAPTER XXVIII	270
CHAPTER XXIX	280
CHAPTER XXX	290
CHAPTER XXXI	300
CHAPTER XXXII	310
CHAPTER XXXIII	320
CHAPTER XXXIV	330
CHAPTER XXXV	340
CHAPTER XXXVI	350
CHAPTER XXXVII	360
CHAPTER XXXVIII	370
CHAPTER XXXIX	380
CHAPTER XL	390
CHAPTER XLI	400
CHAPTER XLII	410
CHAPTER XLIII	420
CHAPTER XLIV	430
CHAPTER XLV	440
CHAPTER XLVI	450
CHAPTER XLVII	460
CHAPTER XLVIII	470
CHAPTER XLIX	480
CHAPTER L	490
CHAPTER LI	500
CHAPTER LII	510
CHAPTER LIII	520
CHAPTER LIV	530
CHAPTER LV	540
CHAPTER LVI	550
CHAPTER LVII	560
CHAPTER LVIII	570
CHAPTER LIX	580
CHAPTER LX	590
CHAPTER LXI	600
CHAPTER LXII	610
CHAPTER LXIII	620
CHAPTER LXIV	630
CHAPTER LXV	640
CHAPTER LXVI	650
CHAPTER LXVII	660
CHAPTER LXVIII	670
CHAPTER LXIX	680
CHAPTER LXX	690
CHAPTER LXXI	700
CHAPTER LXXII	710
CHAPTER LXXIII	720
CHAPTER LXXIV	730
CHAPTER LXXV	740
CHAPTER LXXVI	750
CHAPTER LXXVII	760
CHAPTER LXXVIII	770
CHAPTER LXXIX	780
CHAPTER LXXX	790
CHAPTER LXXXI	800
CHAPTER LXXXII	810
CHAPTER LXXXIII	820
CHAPTER LXXXIV	830
CHAPTER LXXXV	840
CHAPTER LXXXVI	850
CHAPTER LXXXVII	860
CHAPTER LXXXVIII	870
CHAPTER LXXXIX	880
CHAPTER LXXXX	890
CHAPTER LXXXXI	900
CHAPTER LXXXXII	910
CHAPTER LXXXXIII	920
CHAPTER LXXXXIV	930
CHAPTER LXXXXV	940
CHAPTER LXXXXVI	950
CHAPTER LXXXXVII	960
CHAPTER LXXXXVIII	970
CHAPTER LXXXXIX	980
CHAPTER LXXXXX	990
CHAPTER LXXXXXI	1000

### UNDERLYING PHILOSOPHY

If we know the condition of the forest today,  
and how it reacts to our treatment of yesterday, we  
are in the best possible position to control its  
development tomorrow.

### SUBSEQUENT INVENTORIES

Continuity of operation can be attained only by a frequently repeated measurement of the ever changing forest.

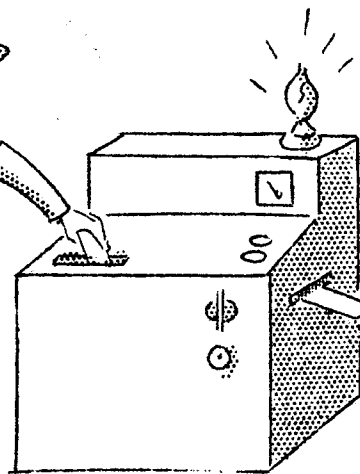
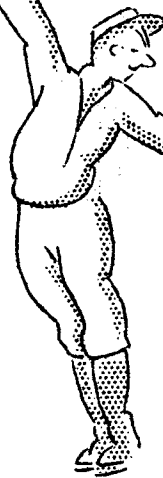
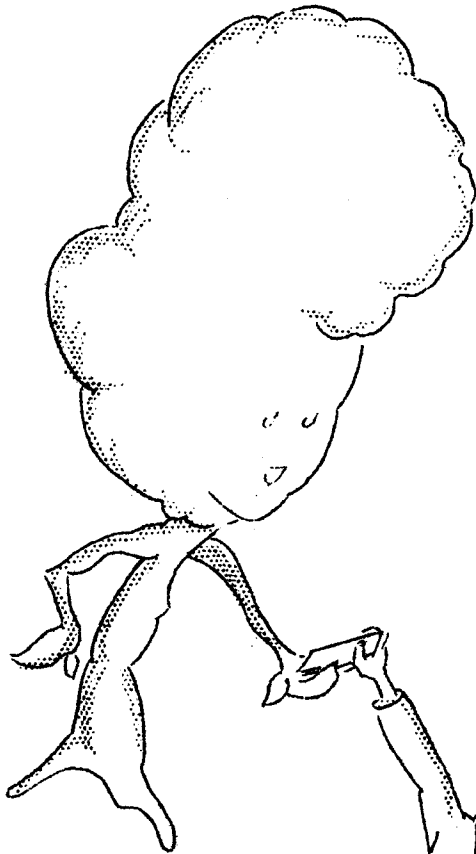


### SUBSEQUENT ANALYSES

Comparative analysis of the measured change in forest condition provides for the continual adjustment of uncertain provisions in existing management plans.

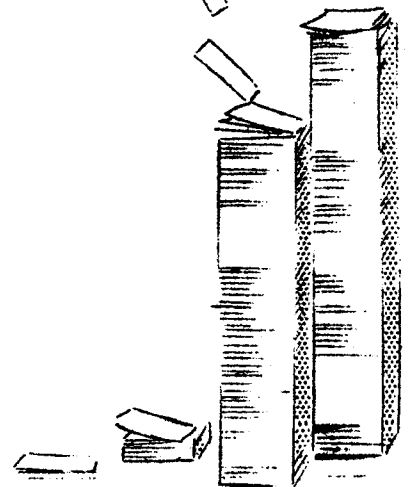
### THE FIRST INVENTORY

There can be no reliance placed upon hasty, incomplete generalizations about parts of the forest, but only upon the results of an analytical assay of the whole forest.



### THE FIRST ANALYSIS

Stability of control can be assured only by thorough examination of the facts collected. This is basic to the success of the inventory and results in the "Forest Management Plan"



## T H E   G O A L

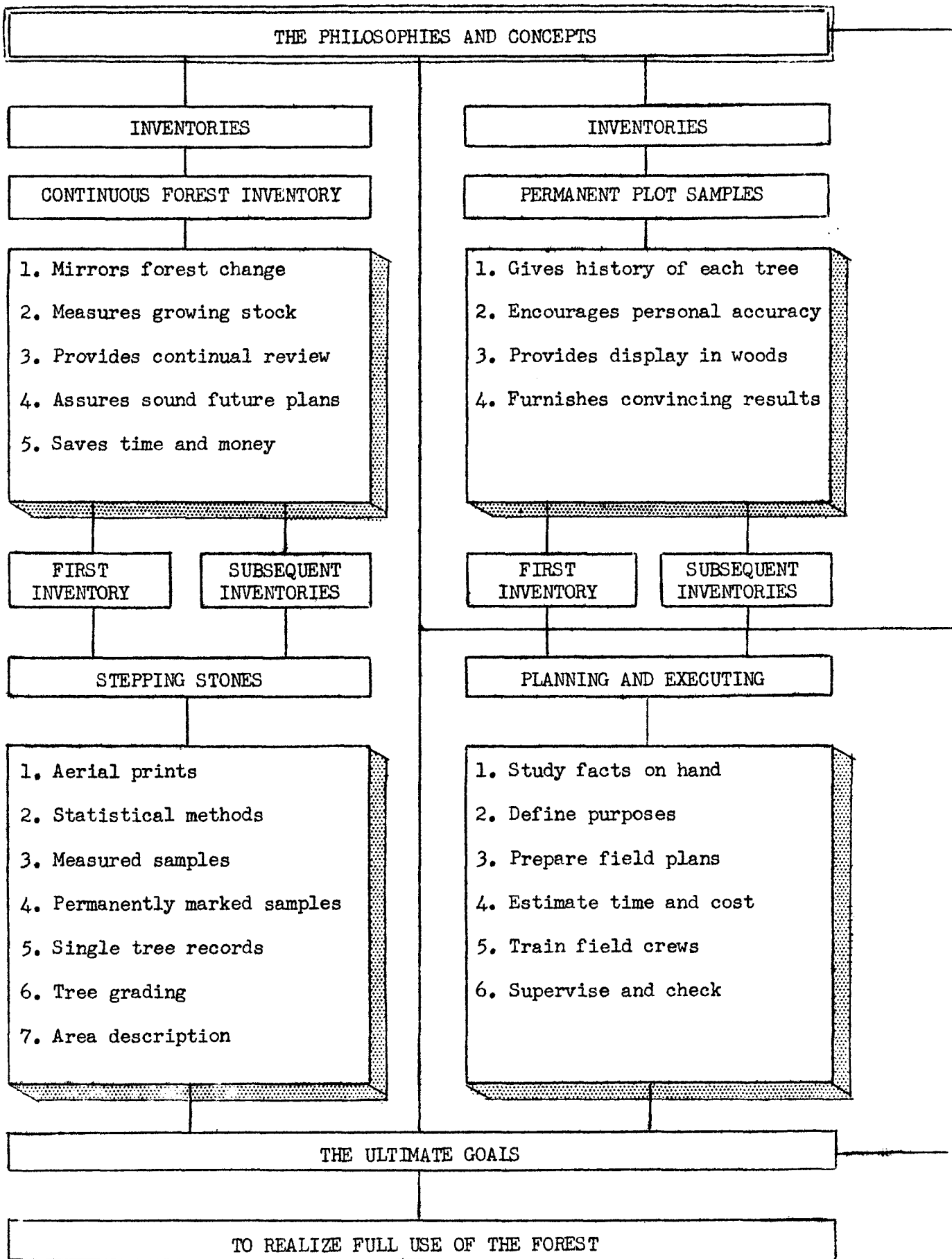
With our forest heritage we have acquired two debts which obligate us to a system of continuous forest control. The first is to realize for ourselves the full and unwasteful use of the resource. The second is to bequeath it to future generations in an improved condition.

Stability of control and continuity of operation at high production levels can be accomplished only by a continual scrutiny of the condition of the forest, and the application of constant compensations for change.



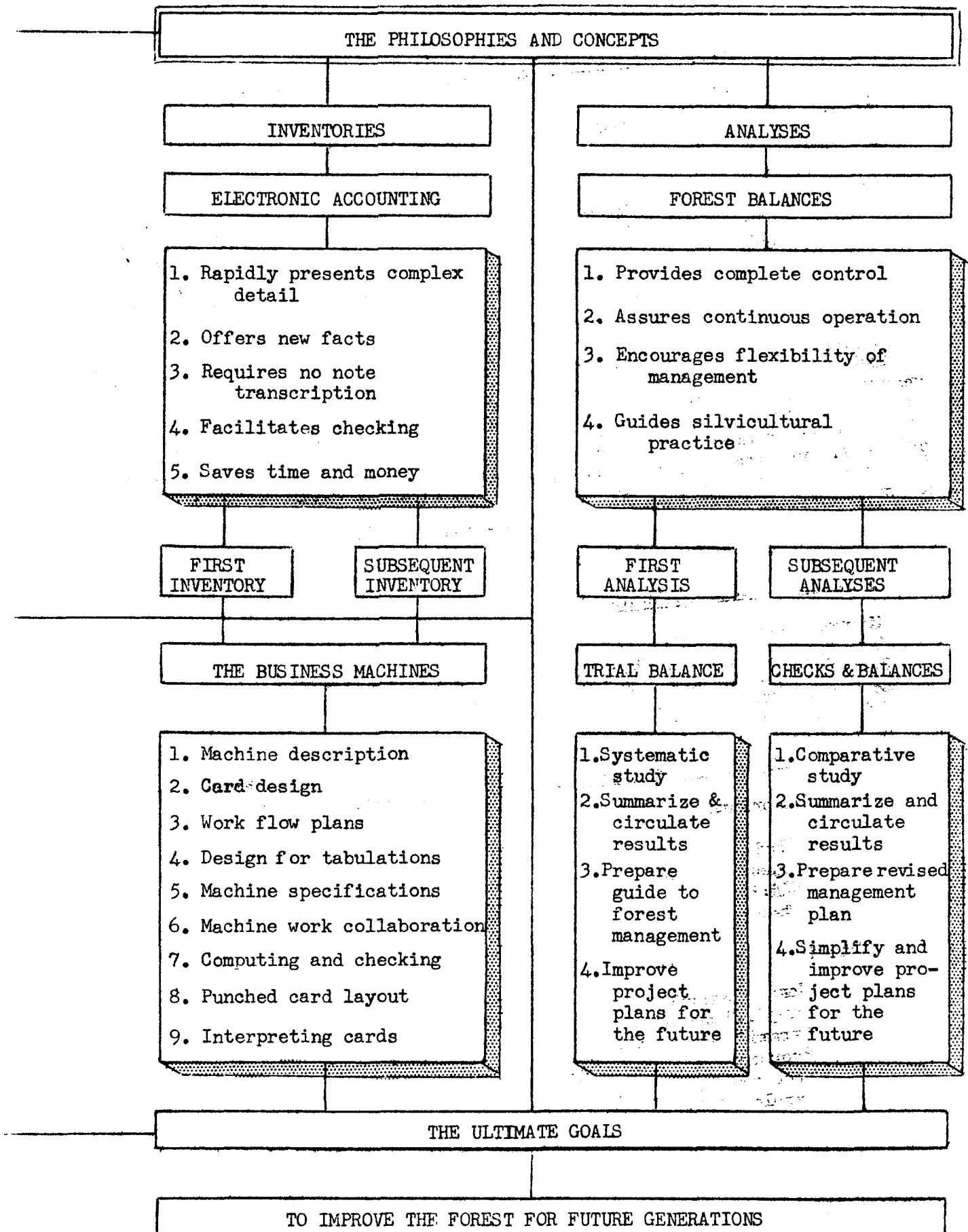
## CONTINUOUS FOREST CONTROL

A System of Checks and Balances for the Management of the Forest



## CONTINUOUS FOREST CONTROL

### A System of Checks and Balances for the Management of the Forest



## CONTINUOUS FOREST CONTROL

### A System of Checks and Balances for the Management of the Forest

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#### PHILOSOPHIES AND CONCEPTS

The old philosophy of maintaining a renewable resource can, we believe, be guaranteed through the use of new concepts which we would present in this undertaking.

In the forest we must reconcile ourselves to perpetual inventories which are the only safe insurance for continuous control and operation. Since we are concerned with the living growing forest we are confronted with the problem of developing this inventory along natural lines. We direct our inventory work toward an ultimate system of what might be called natural selection silviculture.

The forester can no longer limit his abilities to "bull of the woods" cruising of timber. With the new techniques proposed he becomes a certified forest accountant responsible for the compilation of a woods account ledger setting forth capital gains and losses in the forest. The system of trial balances assures him of complete flexibility of operation and provides a means for frequent adjustment to physical and economic changes. Furthermore, timber bookkeeping brings to the forester a sound and ready means for the settlement of that common conflict in the minds of so many industrial forest landowners--liquidation versus sustained yield.

#### 1. CONTINUOUS FOREST INVENTORY

Mirrors change in the forest  
Measures the growing stock  
Provides continual review of the forest  
Assures sound planning for the future  
Offers economy of time and money

#### Stepping Stones to Continuous Forest Inventory

##### Aerial prints

Kind  
Importance  
Flights  
Stereo

##### Statistical methods

Common standards  
Simplifications  
Stratified sampling  
Proportionate sampling  
Tree and area bias  
Sample plot layout

## Measured sample

- Trees and plots
- Personal accuracy
- Philosophy of measured sample
- Psychology of certain refinements
- Needless refinements
- Standard tree dimensions
- Sample trees
- Measuring techniques for trees and plots
- When to measure
- Frequency of measurement
- The time it takes
- Sample vs. 100% records for small areas
- Measuring tools
- Tool maintenance
- The diameter tape technique

## Permanent identification of trees and plots

- Paint; its use and life
- Paint numbering techniques
- Tree tags of aluminum foil
- Unsatisfactory numbering methods
- The tree location grid
- Numbering small and large trees
- Use of the Super Eagle Oiler No. 66

## Single tree records

- Importance
- Flexibility
- Varying utilization
- Units of measure
- Simplified computation

## Systematic tree grading

- Good and bad trees
- Cut and leave trees
- Vigor-Risk-Quality classes
- Physiological age
- Tree health quotients
- Earning power of trees
- Tree quality
- Actual age determination
- Soundness classification
- Grade variation by species
- Weighted tree grading rules
- Growth as a measure of tree health
- Sample tree grading rules

Forest area description

- Aerial interpretation
- Ground determination of cover class
- The forest condition class
- Ecological tree colonies

2. PERMANENT PLOT AND TREE RECORDS ON A SAMPLING BASIS

- Gives complete history of trees, stands, and whole forests
- Encourages personal accuracy and responsibility
- Provides convenient on-the-ground display
- Offers convincing results

Planning and Executing Field Inventories

Study the facts on hand from past inventories

- Original purposes
- Freshness
- Completeness
- Reliability

Define purposes of proposed inventory

- Business objectives
- Scientific objectives

Prepare the field inventory plans

- Time and place
- Techniques
- Standards and codes
- Intensity
- Field and accounting correlation
- Making card records
- Sample plans

Time and cost of field inventory

- Time of year
- Size of crew
- Detail and refinement
- Relation to plot layout
- Topography
- Cover
- General accessibility

### Training the field crews

- The will to work
- The spirit of careful work
- Uniformity of interpretation of standards
  - Cruisers and timber markers
  - Between crews
- Training from pre-established test runs
- Follow up in training
- Importance of understanding the subsequent accounting job

### Field checks and supervision

- Checking the established plots
- Importance of permanent records of checks
- Elimination of misfit personnel
- Remeasuring poorly handled plots

## 3. ELECTRONIC ACCOUNTING

- Facilitates a rapid presentation of complex detail
- Provides new facts not hitherto available
- Requires no note transcription
- Makes checking easy
- Economical throughout

### The Business Machines

#### Kinds of machines

#### Fundamental principles of operation

- The key punch
  - Note transcription

- The sorter
  - Card segregation

- The reproducing punch
  - Mark sense punching
  - Gang punching

- The accounting machine
  - Tabulating

- The calculating punch
  - Computing

- The interpreter
  - Card reading

- The collator
  - Card comparison

#### 4. FOREST BALANCES

- Provide control by continual inventory
  - Assures full use of growth
  - Adjusts cut to growth
- Assure continuous operation of dependent industry
- Encourage flexibility of management
  - Answers quickly secured
  - Results promptly applied
- Furnish fundamental guides to silvicultural practice

##### Analysis of the Inventory

The trial balance

- Systematic study of results
- Summary of analysis
- Circulation of summary
- Preparation of forest management guides
  - Regulation of the cut
  - Silvicultural standards
  - Area breakdowns
    - The cutting series
    - Logging progression
    - Forest condition classes
    - Utilization changes

Checks and balances

- Comparative study of first and second inventories
  - Growth, mortality and ingrowth
  - Capital and surplus
  - Forest investment values

- Reports to company and stockholders
  - Annual and periodic
  - Importance of brevity

- Revision of existing management plans
  - Breakdown limitations
  - Additional sampling

- Constant study of whole process
  - Simplification
  - Cost reduction

#### C O S T   D E T E R M I N A T I O N   A N D   A N A L Y S I S

Continuous forest inventory with electronic accounting is not a costly operation. Costs vary with intensity which in turn varies with the objective of management. In general it may be said that this system of survey is not as time consuming as other systems in common use, and that it provides management information not hitherto available.

#### T H E   U L T I M A T E   G O A L S

We have declared our goal to be complete use and maximum improvement of the forest. This means to us tangible and intangible values alike. Fortunately, by sustaining and improving one we sustain and improve the other.

"For a great door and effectual is  
opened unto me and there are many  
adversaries."

- St. Paul  
First Corinthians, 16:9

The authors, whose constant work  
for many years has been in the field  
of continuous forest inventory, will  
supply additional information on  
request and without charge.

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LEE WINNER, Forester  
U. S. Department of Interior  
Indian Service  
Neopit, Wisconsin

*Cal Stott*

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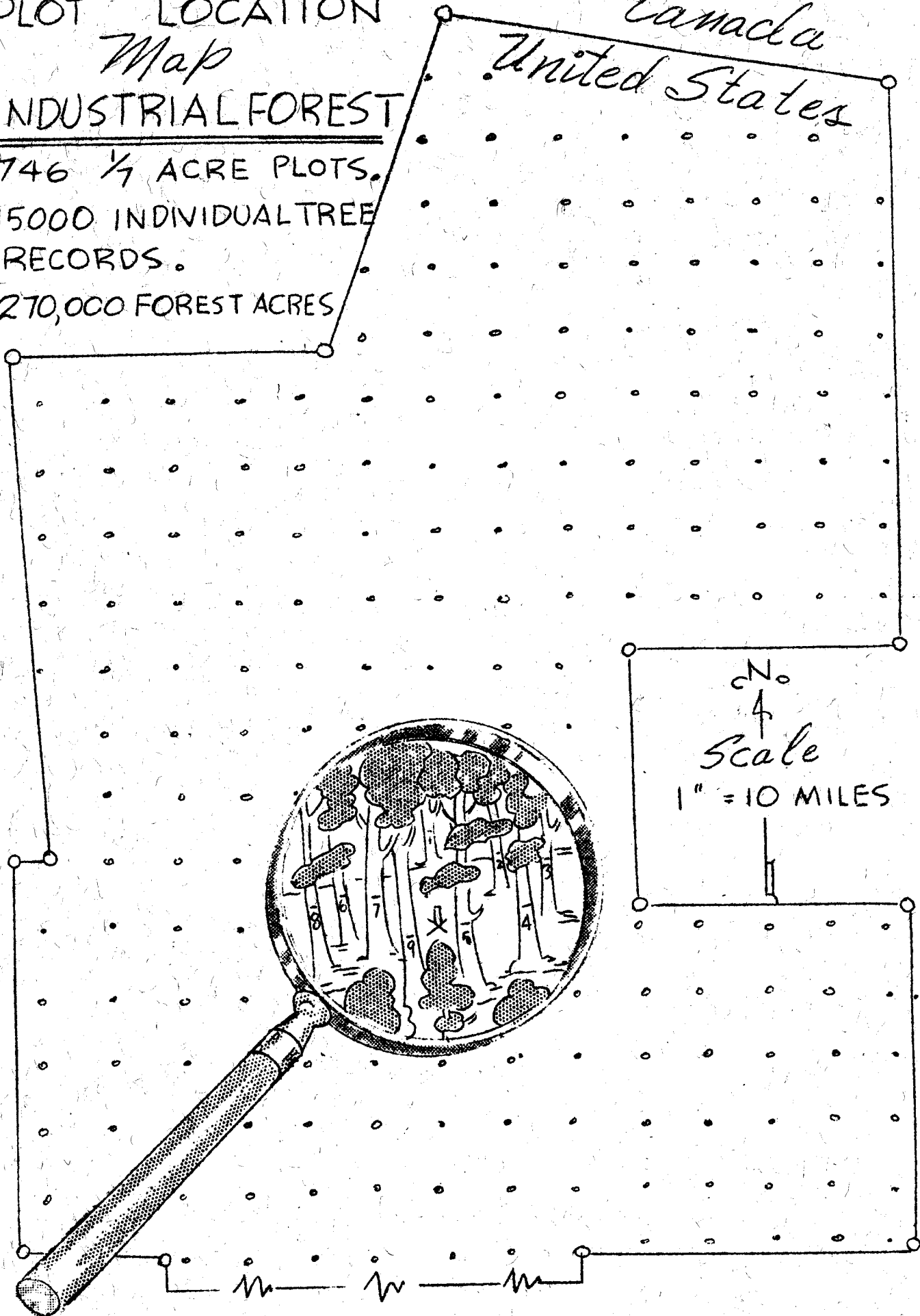
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PLOT LOCATION  
*Map*  
INDUSTRIAL FOREST

746  $\frac{1}{4}$  ACRE PLOTS.  
15000 INDIVIDUAL TREE  
RECORDS.  
270,000 FOREST ACRES

*Canada*  
*United States*



N  
↑  
*Scale*  
1" = 10 MILES